

# PATENT ABSTRACTS OF JAPAN

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(54) ELECTRONIC EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To completely prevent such failures as disconnection, etc., that are caused by the stress generated at a folded part by building the coils into a movable part to perform the transfer of data and power supplies via a non- contact system of the coils.

SOLUTION: The electromagnetic connection parts 2 and 2' are provided on the backs of the 1st and 2nd divided pieces 1 and 10, so that both parts 2 and 2' are placed opposite to each other when a liquid crystal display added to the piece 10 is held up at an angle covering the visible range of a user. The part 2 contains signal coils consisting of magnetic cores 6a to 6p which are wound by the coils 7a to 7q in a prescribed number of turns and also contains a power coil consisting of a magnetic core 6q which is wound by the coils 7q and 7r in a prescribed number of turns. Furthermore, the part 2' also contains the same coils as the part 2. In such a constitution, the data and power supplies can be transferred in a non-contact system including the coils 7a to 7r.

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## CLAIMS

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[Claim(s)]

[Claim 1] Electronic equipment characterized by having moving part, building a coil in the interior of said moving part in the electronic equipment which performs the data between the mounting substrates built in the 1st base connected by this moving part and the 2nd base, and an exchange of a power source, and performing an exchange of data and a power source by the non-contact method with this coil.

[Claim 2] Electronic equipment characterized by attaining transfer of data and a power source in electronic equipment according to claim 1 only in the movable range in which the closing motion include angle of said moving part was limited.

[Claim 3] The closing motion include angle of the moving part whose transfer of data and a power source is attained in electronic equipment according to claim 2 is electronic equipment characterized by being in agreement with the include angle from which the use of said electronic equipment user which is a device is attained.

[Claim 4] Electronic equipment characterized by the 1st base and 2nd base being physically separable in moving part in electronic equipment according to claim 1.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] The main fields of the invention of this invention consist of the 1st base and 2nd base which are connected by moving part, and raise especially the mechanical dependability of the moving part with respect to the personal digital assistant device which can be folded up and carried in a compact.

[0002]

[Description of the Prior Art] In recent years, carrying-ization of various electronic equipment is briskly advanced with the miniaturization of electronic equipment, and power-saving. A portable telephone, PDA, a notebook sized personal computer, etc. are typical. In order to raise the portability and storability in these small personal digital assistant device, there are some as for which fold up some bodies and the dimension at the time of receipt is made to a compact. Drawing 18 is a perspective view of the portable telephone of the example of representation of a personal digital assistant device which has the folding section. Drawing 19 is the enlarged drawing of the E section of drawing 18. The portable telephone of this example the telephone number, various messages, etc. The liquid crystal display 4 for displaying, and the telephone number The second division object 10 which built in the transmission section 23 for transmitting the first division object 1 and voice which have arranged functionally the antenna 24 for transmitting and receiving the key carbon button 5 for inputting, the receiver section 22 which generates the voice which received, and an electric wave is connected by the machine bond parts 3a and 3b. The machine bond parts 3a and 3b have CHOOTSUGAI structure, and closing motion of the first division object 1 and the second division object 10 is attained like the book. Electric connection in the connection section of the first division object 1 and the second division object 10 is made by connecting the first mounting substrate 25 built in the first division object 1 using the flexible wiring 27 which carries out chemical etching of the copper foil, and comes to form a predetermined circuit pattern on a polyimide film, and the second mounting substrate 26 built in the second division object 10. 28 is a microphone which receives transmission voice. The flexible wiring 27 is thin, and since it is comparatively strong to bending-proof nature, it is used for the electrical connection of such the bending section. However, with such structure, since

wiring is outside exposed, it is easy to generate the trouble by penetration of the moisture from damage by physical external force, and the outside etc. Moreover, in order for stress to join wiring at the time of bending, there is a limitation also in the dependability in bending of a repeat. In addition, although lead wire may be wired through the interior of the machine bond part 3 as structure where the flexible wiring 27 is not used although illustration is not carried out, it is difficult to repeat also in this case and to guarantee the dependability by bending completely, and it possible that a poor open circuit occurs in the use over a long period of time.

[0003]

[Problem(s) to be Solved by the Invention] Since the personal digital assistant device which has the conventional plaiting-machine style described above was performing electrical installation between division objects with physical wiring, it had the trouble in folding of a repeat that environmental dependability was mechanically low. It is in the purpose of this invention offering the plaiting-machine style with the high dependability by the electromagnetic coupling which does not mind physical wiring for an exchange of a signal and a power source.

[0004]

[Means for Solving the Problem] The means for attaining the above purpose has moving part, builds a coil in the interior of said moving part in the electronic equipment which performs the data between the mounting substrates built in the 1st base connected by this moving part and the 2nd base, and an exchange of a power source, and offers a reliable plaiting-machine style by performing an exchange of data and a power source by the non-contact method with this coil.

[0005]

[Function] Since no external stress is given to the member which constitutes an internal circuit at the time of folding since the personal digital assistant device which has the plaiting-machine style constituted by the above-mentioned means does not have physical wiring in the folding section, also in folding of a repeat, dependability is securable. Moreover, since confidentiality is raised, the dependability over an environment can also be raised.

[0006]

[Example] The 1st example of this invention is explained using drawing 1 - drawing 8 .

[0007] Drawing 1 is the perspective view showing the word processor of the notebook mold which is an example of electronic equipment which used the inductive coupler of this invention. Drawing 2 is the expansion perspective drawing of the electromagnetic-coupling section ( drawing 1 A section) of the word processor shown in drawing 1 . A word processor contains the electronic parts of CPU or others in the interior, contains electronic parts, such as a LCD driver, in the division object 1 and the interior of the first key carbon button 5 comes to align inside on a front face, and has the structure where the second division object 10 which installed the liquid crystal display 4 in the front face was connected by two machine bond parts 3a and 3b. The machine bond parts 3a and 3b have for example, CHOOTSUGAI structure, fold up the first division object 1 and the second division object 10 by mechanical movement, and enable it to have contained them in the compact. When the liquid crystal display 4 installed in the tooth back of the first division object 1 and the second division object 10 by the second division object 10 at the time of use is lifted by the include angle settled in the visible range of a user, the electromagnetic-coupling section 2 and 2' are arranged so that it may counter. Inside the electromagnetic-coupling section 2 The magnetic cores 6a, 6b, 6c, 6d, 6e, 6f, and 6g the \*\*\*\*\* coils 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, 7i, 7j, 7k, 7l, 7m, 7n, 7o, and 7p withered several predetermined turns, The coil for power sources which consists of magnetic core 6q 16 coils for signals which consist of 6h, 6i, 6j, 6k, 6l, 6m, 6n, 6o, and 6p, and coils 7q and 7r withered

several predetermined turns is built in. The same coil is built in so that these coils may be faced also inside electromagnetic-coupling section 2'. In order to transmit the signal of a RF to the magnetic cores 6a-6p and 6a'-6p' which are an object for signals by the electromagnetic coupling efficiently, in consideration of effectiveness, hysteresis loss, etc. of association of a cylinder-like sintering nickel-Zn ferrite with the magnetic core for power sources, the sintering Mn-Zn ferrite of E mold is used. In addition, the coil for power sources has carried out the coil of the coil to the business which forms two magnetic paths with one magnetic core at two places.

[0008] Next, the principle of a signal and power-source transmission is explained using drawing 3. Drawing 3 is the block diagram showing the situation of data communication which used the inductive coupler. The signal to the liquid crystal display 4 of the word processor shown in drawing 1 and power-source transmission are explained to an example. The control signal for driving a liquid crystal display (LCD) 4, an address signal, and a data signal are sent to the first division object 1. A signal is changed into magnetic flux with each coils 7a-7p. It interlinks to each coil 7a' by which the generated magnetic flux is installed in the second division object 10 - 7p', and a signal is transmitted by "Lenz's law." Since the signal wave form received by each coil 7a' installed in the second division object 10 - 7p' is a bimodal wave peculiar to an electromagnetic coupling, it is changed into the digital wave of waveform shaping circuit 11 predetermined level. After that, a signal is inputted into the LCD driver 12 like the general liquid crystal display driving method, and a liquid crystal display 4 is driven. When there are few coils for signals which can be installed by limit of storage space than a signal line, a logical circuit may be added and a time-sharing transfer may be performed. Moreover, a power source changes into a predetermined pulse shape the DC power supply supplied from the power-source line built in the first division object 1 by the electromagnetic-coupling power transmission circuit 8 which consists of an oscillator circuit 801 and a coil driver 802, and is sent to the coils 7q and 7r for power sources. a signal -- the same -- electromagnetic induction -- the -- two -- division -- the body -- ten -- installing -- having -- a power source -- \*\* -- a coil -- seven -- q -- ' -- seven -- r -- ' -- having won popularity -- alternating current power -- a direct current -- rectifying -- rectification - a smoothing circuit -- 901 -- fixed -- an electrical potential difference -- stabilizing -- a voltage stabilizer -- 902 -- from -- constituting -- having -- an electromagnetic coupling -- an incoming circuit -- nine -- the -- two -- division -- the body -- ten -- the interior -- various kinds -- electronic parts -- supplying -- having .

[0009] Drawing 4 is the top view showing the side face of the electromagnetic-coupling section of the word processor shown in drawing 1. When only the include angle theta 1 with the second division object 10 occurred and goes up, the electromagnetic-coupling section 2 and 2' are arranged so that an internal coil comrade may do \*\*\*\*\* opposite. An include angle theta 1 is set as arbitration in the visible range of a liquid crystal display. If the second division object 10 is folded up at the time of storing, distance will leave the electromagnetic-coupling section 2 and 2', supply voltage falls, and since the circuit inside [ division object 10 ] the second suspends actuation, it can prevent useless power consumption other than the time of use. The first division object 1 and the second division object 10 are physically connected only by the machine bond part 3, get down, and concentrate the stress at the time of folding only on the machine bond part 3. Therefore, mechanical dependability is determined by the structure of \*\*\*\*\* 3 and can be separated from communicative dependability. That is, what is necessary will be just to secure dependability, such as wear, deformation, etc. of the machine bond part 3 in mechanical movement.

[0010] It is the perspective view of the coil aggregate which is an example of the mounting gestalt of the coil built in drawing 5 at the electromagnetic-coupling section of the word processor in which drawing 1 was shown. Drawing 6 is the B-B' sectional view of the coil aggregate shown in drawing 5. This is assembled on one components (coil aggregate) so that it may be easy to mount two or more coils. The coil aggregate 20 the coil for signals whose coils 7a-7j were in the magnetic cores 6a-6j of the shape of a cylinder [ two or more (drawing ten pieces) ] predetermined [ several ], and the coil for power sources whose coils 7k and 7l were in magnetic core 6k of E mold predetermined [ several ] by mold resin, such as PPS and a liquid crystal polymer, the external terminal 14 It holds with the coil base 13 which it really comes to fabricate, and has the structure which connected the end of a coil to the edges 15a-15l. of the external terminal 14 which consists of phosphor bronze, and 15a' - 15l.' in solder 16a-16l. and 16a' - 16l.', respectively. According to this structure, since shaping precision \*\*\*\*\* of the coil base 13 is carried out, the location precision of each coil is highly precise. Moreover, the dependability as components can be raised by embedding the whole by mold resin 17 so that it may be shown drawing 7 and only the external terminal 14 may be exposed. According to the above-mentioned structure, two or more coils can mount at once, and productivity improves.

[0011] Drawing 8 is the perspective view showing the condition of having separated the first division object of a word processor and the second division object which were shown in drawing 1. Since the second division object 10 does not have physical wiring, it is easily separable by removing the check pins 301a and 301b which constitute the machine bond part 3. Therefore, according to the configuration of this invention, components failure and exchange by the upgrade of components can be performed easily. Moreover, it is also possible by dissociating to be able to miniaturize more and to raise portability and storability further. Furthermore, since physical wiring is not needed, full sealing structure is also possible, and improvement in maintenance nature, such as an application in the inside where an environment is severe, and washing in cold water, can also be expected.

[0012] Drawing 9 and drawing 10 are the top views showing the 2nd example which extends the communication link range of the electromagnetic-coupling section of the word processor shown in drawing 1. Although the communication link in the location where the visible range was restricted was possible for the above-mentioned example, as for the visible range, it is desirable for there to be a certain amount of width of face, and to also secure the communication link range in a certain range by a user's form and the posture. Drawing 9 prepares R in the magnetic core 6 and the opposite section of 6', and it is made for joint effectiveness to seldom change in a certain include-angle range theta 2. Drawing 10 installs the moving-coil electrode holder 18 which contained the coil in the electromagnetic-coupling section by the side of the first division object 1, and enables it to follow migration of the second division object 10 with the forcing spring 19.

[0013] The third example is explained using drawing 11 - drawing 17. Drawing 11 is the perspective view showing the word processor of the note type which has the inductive coupler of this invention. Drawing 12 is the expansion perspective view of the electromagnetic-coupling section of the word processor shown in drawing 11. Electromagnetic-coupling section 2b formed in the electromagnetic-coupling sections 2a and 2c and the second division object 10 with which the data between the first division object 1 and the second division object 10 and an exchange of power were formed in the first division object 1 in the shape of a ctenidium in the shape of a ctenidium gears. The coil of the coil 7a, 7b of a predetermined number is carried out to magnetic core 6' of the shape of a cylinder built in the electromagnetic-coupling sections 2a and

2c, and 6b. magnetic core 6a' of the shape of a cylinder built in the coil for signals constituted, and electromagnetic-coupling section 2b, and 6b -- -- coil 7a of a predetermined number -- the coil for signals constituted by carrying out the coil of the '7b' faces each other on the revolving shaft of the machine bond parts 3a and 3b, and is performed. Since physical relationship with the coil comrade relative on the revolving shaft of the folding actuation by the communication link of the first division object 1 and the second division object 10 who communicates a coil by rotation actuation is arranged so that eternally, even if it makes which location rotate the second division object 10, there is no effect in communicative dependability.

[0014] Drawing 13 is the d-d' sectional view of the electromagnetic-coupling section of the word processor shown in drawing 11. What carried out the coil of the coil 7 and constituted it to the pot core 6 as shows magnetic flux to drawing 15 which can be collected efficiently is used for the power-source coil. Since the gap g of each coil is determined in drawing 13 by the clearance between tabling of the ctenidium-like electromagnetic-coupling section, it is decided in consideration of the effectiveness of association, and \*\*\*\*\* of rotation actuation.

Although the spacing s of the coil built in the same part segmenter is determined in consideration of the effect of a cross talk which gathers the signal of an adjacent channel as a noise, since the width of face w of a ctenidium will become large, the number of coils which can be built in the electromagnetic-coupling section 2 will decrease and transmission speed etc. will be restricted if it detaches too much, it is designed in consideration of an optimum value.

[0015] Moreover, since magnetic flux will be shut up if all coils are made into the thing using a pot core as shown in drawing 14, spacing s of a coil is made small and can increase the number of coils.

[0016] Drawing 16 and drawing 17 are the examples of the coil structure of others in which an electromagnetic coupling is possible in an omnidirection. Drawing 16 communicates through the magnetic core 6 which becomes the coil bobbin 21 made of resin, and the signal coil which carried out the coil of coil 7.7', and constituted it in 21' from a cylinder-like sintering nickel-Zn ferrite. The magnetic core 6 is used for a revolving shaft, and since the both sides of an electromagnetic coupling and machine association are performed and it is not necessary to prepare a machine bond part separately, a configuration becomes simple. However, when the mechanical strength of the magnetic core 6 cannot be guaranteed, a machine bond part may be prepared separately. Drawing 17 communicates combining the coil constituted by carrying out the coil of coil 7' to magnetic core 6' of the shape of a cylinder which becomes the electromagnetic-coupling sections 2a and 2c by the side of the first division object 1 for example, from a sintering nickel-Zn ferrite at electromagnetic-coupling section 2b for example, by the side of the coil constituted by carrying out the coil of the coil 7 to the magnetic core 6 which consists of a sintering nickel-Zn ferrite C mold, and the second division object 10. Joint effectiveness is good in order that this configuration \*\*\*\*\* may close.

[0017]

[Effect of the Invention] As stated above, when the pocket electronic equipment which has an inductive coupler in the folding section of this invention performs an exchange of the signal and the power source which are performed through the folding section by the electromagnetic coupling, it enables it to realize pocket electronic equipment strong against opposite environment nature, such as water and dust, moreover in \*\*\*\*\* to prevent completely the problem of the poor open circuit by the stress generated in the folding section generated conventionally.

TECHNICAL FIELD

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[Industrial Application] The main fields of the invention of this invention consist of the 1st base and 2nd base which are connected by moving part, and raise especially the mechanical dependability of the moving part with respect to the personal digital assistant device which can be folded up and carried in a compact.

## PRIOR ART

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[Description of the Prior Art] In recent years, carrying-ization of various electronic equipment is briskly advanced with the miniaturization of electronic equipment, and power-saving. A portable telephone, PDA, a notebook sized personal computer, etc. are typical. In order to raise the portability and storability in these small personal digital assistant device, there are some as for which fold up some bodies and the dimension at the time of receipt is made to a compact. Drawing 18 is a perspective view of the portable telephone of the example of representation of a personal digital assistant device which has the folding section. Drawing 19 is the enlarged drawing of the E section of drawing 18. The portable telephone of this example the telephone number, various messages, etc. The liquid crystal display 4 for displaying, and the telephone number The second division object 10 which built in the transmission section 23 for transmitting the first division object 1 and voice which have arranged functionally the antenna 24 for transmitting and receiving the key carbon button 5 for inputting, the receiver section 22 which generates the voice which received, and an electric wave is connected by the machine bond parts 3a and 3b. The machine bond parts 3a and 3b have CHOOTSUGAI structure, and closing motion of the first division object 1 and the second division object 10 is attained like the book. Electric connection in the connection section of the first division object 1 and the second division object 10 is made by connecting the first mounting substrate 25 built in the first division object 1 using the flexible wiring 27 which carries out chemical etching of the copper foil, and comes to form a predetermined circuit pattern on a polyimide film, and the second mounting substrate 26 built in the second division object 10. 28 is a microphone which receives transmission voice. The flexible wiring 27 is thin, and since it is comparatively strong to bending-proof nature, it is used for the electrical connection of such the bending section. However, with such structure, since wiring is outside exposed, it is easy to generate the trouble by penetration of the moisture from damage by physical external force, and the outside etc. Moreover, in order for stress to join wiring at the time of bending, there is a limitation also in the dependability in bending of a repeat. In addition, although lead wire may be wired through the interior of the machine bond part 3 as structure where the flexible wiring 27 is not used although illustration is not carried out, it is difficult to repeat also in this case and to guarantee the dependability by bending completely, and it possible that a poor open circuit occurs in the use over a long period of time.

## EFFECT OF THE INVENTION

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[Effect of the Invention] As stated above, when the pocket electronic equipment which has an inductive coupler in the folding section of this invention performs an exchange of the signal and the power source which are performed through the folding section by the electromagnetic coupling, it enables it to realize pocket electronic equipment strong against opposite environment nature, such as water and dust, moreover in \*\*\*\* to prevent completely the problem of the poor open circuit by the stress generated in the folding section generated conventionally.

## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Since the personal digital assistant device which has the conventional plaiting-machine style described above was performing electrical installation between division objects with physical wiring, it had the trouble in folding of a repeat that environmental dependability was mechanically low. It is in the purpose of this invention offering the plaiting-machine style with the high dependability by the electromagnetic coupling which does not mind physical wiring for an exchange of a signal and a power source.

## MEANS

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[Means for Solving the Problem] The means for attaining the above purpose has moving part, builds a coil in the interior of said moving part in the electronic equipment which performs the data between the mounting substrates built in the 1st base connected by this moving part and the 2nd base, and an exchange of a power source, and offers a reliable plaiting-machine style by performing an exchange of data and a power source by the non-contact method with this coil.

## OPERATION

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[Function] Since no external stress is given to the member which constitutes an internal circuit at the time of folding since the personal digital assistant device which has the plaiting-machine style constituted by the above-mentioned means does not have physical wiring in the folding section, also in folding of a repeat, dependability is securable. Moreover, since confidentiality is raised, the dependability over an environment can also be raised.

## EXAMPLE

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[Example] The 1st example of this invention is explained using drawing 1 - drawing 8 .  
[0007] Drawing 1 is the perspective view showing the word processor of the notebook mold which is an example of electronic equipment which used the inductive coupler of this invention. Drawing 2 is the expansion perspective drawing of the electromagnetic-coupling section ( drawing 1 A section) of the word processor shown in drawing 1 . A word processor contains the electronic parts of CPU or others in the interior, contains electronic parts, such as a LCD driver, in the division object 1 and the interior of the first the key carbon button 5 comes to align inside on a front face, and has the structure where the second division object 10 which installed the liquid crystal display 4 in the front face was connected by two machine bond parts 3a and 3b. The machine bond parts 3a and 3b have for example, CHOOTSUGAI structure, fold up the first division object 1 and the second division object 10 by mechanical movement, and enable it to have contained them in the compact. When the liquid crystal display 4 installed in the tooth back of the first division object 1 and the second division object 10 by the second division object 10 at the time of use is lifted by the include angle settled in the visible range of a user, the electromagnetic-coupling section 2 and 2' are arranged so that it may counter. Inside the electromagnetic-coupling section 2 The magnetic cores 6a, 6b, 6c, 6d, 6e, 6f, and 6g the \*\*\*\*\* coils 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, 7i, 7j, 7k, 7l., 7m, 7n, 7o, and 7p withered several predetermined turns, The coil for power sources which consists of magnetic core 6q 16 coils for



signals which consist of 6h, 6i, 6j, 6k, 6l, 6m, 6n, 6o, and 6p, and coils 7q and 7r with several predetermined turns is built in. The same coil is built in so that these coils may be faced also inside electromagnetic-coupling section 2'. In order to transmit the signal of a RF to the magnetic cores 6a-6p and 6a'-6p' which are an object for signals by the electromagnetic coupling efficiently, in consideration of effectiveness, hysteresis loss, etc. of association of a cylinder-like sintering nickel-Zn ferrite with the magnetic core for power sources, the sintering Mn-Zn ferrite of E mold is used. In addition, the coil for power sources has carried out the coil of the coil to the business which forms two magnetic paths with one magnetic core at two places.

[0008] Next, the principle of a signal and power-source transmission is explained using drawing 3. Drawing 3 is the block diagram showing the situation of data communication which used the inductive coupler. The signal to the liquid crystal display 4 of the word processor shown in drawing 1 and power-source transmission are explained to an example. The control signal for driving a liquid crystal display (LCD) 4, an address signal, and a data signal are sent to the first division object 1. A signal is changed into magnetic flux with each coils 7a-7p. It interlinks to each coil 7a' by which the generated magnetic flux is installed in the second division object 10 - 7p', and a signal is transmitted by "Lenz's law." Since the signal wave form received by each coil 7a' installed in the second division object 10 - 7p' is a bimodal wave peculiar to an electromagnetic coupling, it is changed into the digital wave of waveform shaping circuit 11 predetermined level. After that, a signal is inputted into the LCD driver 12 like the general liquid crystal display driving method, and a liquid crystal display 4 is driven. When there are few coils for signals which can be installed by limit of storage space than a signal line, a logical circuit may be added and a time-sharing transfer may be performed. Moreover, a power source changes into a predetermined pulse shape the DC power supply supplied from the power-source line built in the first division object 1 by the electromagnetic-coupling power transmission circuit 8 which consists of an oscillator circuit 801 and a coil driver 802, and is sent to the coils 7q and 7r for power sources. a signal -- the same -- electromagnetic induction -- the -- two -- division -- the body -- ten -- installing -- having -- a power source -- \*\* -- a coil -- seven -- q -- ' -- seven -- r -- ' -- having won popularity -- alternating current power -- a direct current -- rectifying -- rectification - a smoothing circuit -- 901 -- fixed -- an electrical potential difference -- stabilizing -- a voltage stabilizer -- 902 -- from -- constituting -- having -- an electromagnetic coupling -- an incoming circuit -- nine -- the -- two -- division -- the body -- ten -- the interior -- various kinds -- electronic parts -- supplying -- having .

[0009] Drawing 4 is the top view showing the side face of the electromagnetic-coupling section of the word processor shown in drawing 1. When only the include angle theta 1 with the second division object 10 occurred and goes up, the electromagnetic-coupling section 2 and 2' are arranged so that an internal coil comrade may do \*\*\*\*\* opposite. An include angle theta 1 is set as arbitration in the visible range of a liquid crystal display. If the second division object 10 is folded up at the time of storing, distance will leave the electromagnetic-coupling section 2 and 2', supply voltage falls, and since the circuit inside [ division object 10 ] the second suspends actuation, it can prevent useless power consumption other than the time of use. The first division object 1 and the second division object 10 are physically connected only by the machine bond part 3, get down, and concentrate the stress at the time of folding only on the machine bond part 3. Therefore, mechanical dependability is determined by the structure of \*\*\*\*\* 3 and can be separated from communicative dependability. That is, what is necessary will be just to secure dependability, such as wear, deformation, etc. of the machine bond part 3 in mechanical movement.

[0010] It is the perspective view of the coil aggregate which is an example of the mounting gestalt of the coil built in drawing 5 at the electromagnetic-coupling section of the word processor in which drawing 1 was shown. Drawing 6 is the B-B' sectional view of the coil aggregate shown in drawing 5. This is assembled on one components (coil aggregate) so that it may be easy to mount two or more coils. The coil aggregate 20 the coil for signals whose coils 7a-7j were in the magnetic cores 6a-6j of the shape of a cylinder [ two or more (drawing ten pieces) ] predetermined [ several ], and the coil for power sources whose coils 7k and 7l were in magnetic core 6k of E mold predetermined [ several ] by mold resin, such as PPS and a liquid crystal polymer, the external terminal 14 It holds with the coil base 13 which it really comes to fabricate, and has the structure which connected the end of a coil to the edges 15a-15l. of the external terminal 14 which consists of phosphor bronze, and 15a' - 15l.' in solder 16a-16l. and 16a' - 16l.', respectively. According to this structure, since shaping precision \*\*\*\*\* of the coil base 13 is carried out, the location precision of each coil is highly precise. Moreover, the dependability as components can be raised by embedding the whole by mold resin 17 so that it may be shown drawing 7 and only the external terminal 14 may be exposed. According to the above-mentioned structure, two or more coils can mount at once, and productivity improves.

[0011] Drawing 8 is the perspective view showing the condition of having separated the first division object of a word processor and the second division object which were shown in drawing 1. Since the second division object 10 does not have physical wiring, it is easily separable by removing the check pins 301a and 301b which constitute the machine bond part 3. Therefore, according to the configuration of this invention, components failure and exchange by the upgrade of components can be performed easily. Moreover, it is also possible by dissociating to be able to miniaturize more and to raise portability and storability further. Furthermore, since physical wiring is not needed, full sealing structure is also possible, and improvement in maintenance nature, such as an application in the inside where an environment is severe, and washing in cold water, can also be expected.

[0012] Drawing 9 and drawing 10 are the top views showing the 2nd example which extends the communication link range of the electromagnetic-coupling section of the word processor shown in drawing 1. Although the communication link in the location where the visible range was restricted was possible for the above-mentioned example, as for the visible range, it is desirable for there to be a certain amount of width of face, and to also secure the communication link range in a certain range by a user's form and the posture. Drawing 9 prepares R in the magnetic core 6 and the opposite section of 6', and it is made for joint effectiveness to seldom change in a certain include-angle range theta 2. Drawing 10 installs the moving-coil electrode holder 18 which contained the coil in the electromagnetic-coupling section by the side of the first division object 1, and enables it to follow migration of the second division object 10 with the forcing spring 19.

[0013] The third example is explained using drawing 11 - drawing 17. Drawing 11 is the perspective view showing the word processor of the note type which has the inductive coupler of this invention. Drawing 12 is the expansion perspective view of the electromagnetic-coupling section of the word processor shown in drawing 11. Electromagnetic-coupling section 2b formed in the electromagnetic-coupling sections 2a and 2c and the second division object 10 with which the data between the first division object 1 and the second division object 10 and an exchange of power were formed in the first division object 1 in the shape of a ctenidium in the shape of a ctenidium gears. The coil of the coil 7a, 7b of a predetermined number is carried out to magnetic core 6' of the shape of a cylinder built in the electromagnetic-coupling sections 2a and

2c, and 6b. magnetic core 6a' of the shape of a cylinder built in the coil for signals constituted, and electromagnetic-coupling section 2b, and 6b -- -- coil 7a of a predetermined number -- the coil for signals constituted by carrying out the coil of the '7b' faces each other on the revolving shaft of the machine bond parts 3a and 3b, and is performed. Since physical relationship with the coil comrade relative on the revolving shaft of the folding actuation by the communication link of the first division object 1 and the second division object 10 who communicates a coil by rotation actuation is arranged so that eternally, even if it makes which location rotate the second division object 10, there is no effect in communicative dependability.

[0014] Drawing 13 is the d-d' sectional view of the electromagnetic-coupling section of the word processor shown in drawing 11. What carried out the coil of the coil 7 and constituted it to the pot core 6 as shows magnetic flux to drawing 15 which can be collected efficiently is used for the power-source coil. Since the gap g of each coil is determined in drawing 13 by the clearance between tabling of the ctenidium-like electromagnetic-coupling section, it is decided in consideration of the effectiveness of association, and \*\*\*\*\* of rotation actuation.

Although the spacing s of the coil built in the same part segmenter is determined in consideration of the effect of a cross talk which gathers the signal of an adjacent channel as a noise, since the width of face w of a ctenidium will become large, the number of coils which can be built in the electromagnetic-coupling section 2 will decrease and transmission speed etc. will be restricted if it detaches too much, it is designed in consideration of an optimum value.

[0015] Moreover, since magnetic flux will be shut up if all coils are made into the thing using a pot core as shown in drawing 14, spacing s of a coil is made small and can increase the number of coils.

[0016] Drawing 16 and drawing 17 are the examples of the coil structure of others in which an electromagnetic coupling is possible in an omnidirection. Drawing 16 communicates through the magnetic core 6 which becomes the coil bobbin 21 made of resin, and the signal coil which carried out the coil of coil 7.7', and constituted it in 21' from a cylinder-like sintering nickel-Zn ferrite. The magnetic core 6 is used for a revolving shaft, and since the both sides of an electromagnetic coupling and machine association are performed and it is not necessary to prepare a machine bond part separately, a configuration becomes simple. However, when the mechanical strength of the magnetic core 6 cannot be guaranteed, a machine bond part may be prepared separately. Drawing 17 communicates combining the coil constituted by carrying out the coil of coil 7' to magnetic core 6' of the shape of a cylinder which becomes the electromagnetic-coupling sections 2a and 2c by the side of the first division object 1 for example, from a sintering nickel-Zn ferrite at electromagnetic-coupling section 2b for example, by the side of the coil constituted by carrying out the coil of the coil 7 to the magnetic core 6 which consists of a sintering nickel-Zn ferrite C mold, and the second division object 10. Joint effectiveness is good in order that this configuration \*\*\*\*\* may close.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the word processor of the notebook mold which is an example of the electronic equipment using the inductive coupler of this invention.

[Drawing 2] It is the expansion perspective drawing of the electromagnetic-coupling section (drawing 1 A section) of the word processor shown in drawing 1.

[Drawing 3] It is the block diagram showing the situation of data communication using an inductive coupler.

[Drawing 4] It is the top view showing the side face of the electromagnetic-coupling section of the word processor shown in drawing 1 .

[Drawing 5] It is the perspective view of the coil aggregate which is an example of the mounting gestalt of the coil built in the electromagnetic-coupling section of the word processor shown in drawing 1 .

[Drawing 6] It is the B-B' sectional view of the coil aggregate shown in drawing 5 .

[Drawing 7] It is the perspective view showing the condition of having carried out the mold of the coil aggregate shown in drawing 5 .

[Drawing 8] It is the perspective view showing the condition of having separated the first division object of a word processor and the second division object which were shown in drawing 1 .

[Drawing 9] It is the top view showing the 2nd example which extends the communication link range of the electromagnetic-coupling section of the word processor shown in drawing 1 .

[Drawing 10] It is the top view showing the 2nd example which extends the communication link range of the electromagnetic-coupling section of the word processor shown in drawing 1 .

[Drawing 11] It is the perspective view showing the word processor of the note type which has the inductive coupler of this invention.

[Drawing 12] It is the expansion perspective view of the electromagnetic-coupling section of the word processor shown in drawing 11 .

[Drawing 13] It is the d-d' sectional view of the electromagnetic-coupling section of the word processor shown in drawing 11 .

[Drawing 14] It is the sectional view of the electromagnetic-coupling section which constituted all coils from a pot core.

[Drawing 15] It is the perspective view showing the coil of the configuration using a pot core.

[Drawing 16] It is the example of the coil structure of others in which an electromagnetic coupling is possible in an omnidirection.

[Drawing 17] They are other examples of the coil structure of others in which an electromagnetic coupling is possible in an omnidirection.

[Drawing 18] It is the perspective view of the portable telephone which is the example of representation of the personal digital assistant device which has the conventional folding section.

[Drawing 19] It is the enlarged drawing of the E section of drawing 18 .

[Description of Notations]

1 First Division Object

2 Electromagnetic-Coupling Section

3 Machine Bond Part

4 Liquid Crystal Display

5 Key Carbon Button

6 Magnetic Core

7 Coil

8 Electromagnetic-Coupling Power Transmission Circuit

9 Electromagnetic-Coupling Incoming Circuit

10 Second Division Object

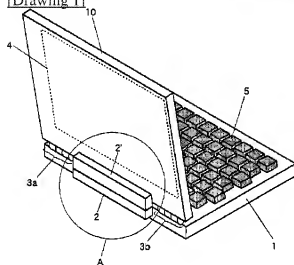
11 Corrugating Circuit

12 LCD Driver

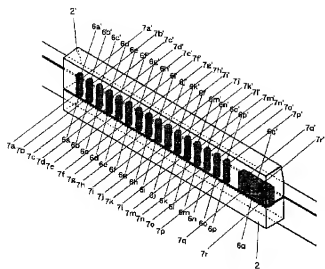
- 13 Coil Base
- 14 External Terminal
- 15 Coil Slot
- 16 Solder
- 17 Mold Resin
- 18 Moving-Coil Electrode Holder
- 19 Forcing Spring
- 20 Coil Aggregate
- 21 Coil Bobbin
- 22 Receiver Section
- 23 Transmission Section
- 24 Antenna
- 25 First Mounting Substrate
- 26 Second Mounting Substrate
- 27 Flexible Wiring
- 28 Microphone

## DRAWINGS

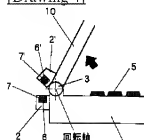
[Drawing 1]



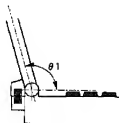
[Drawing 2]



[Drawing 4]

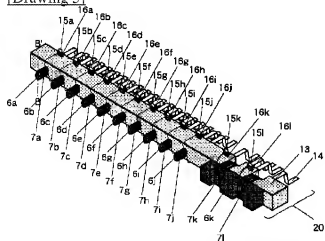


( a )

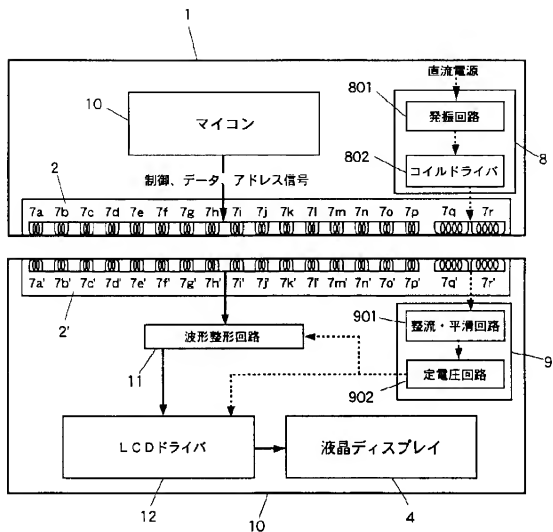


( b )

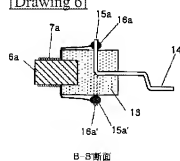
[Drawing 5]



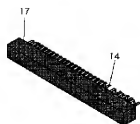
[Drawing 3]



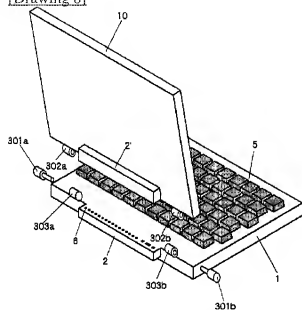
[Drawing 6]



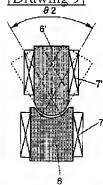
[Drawing 7]



[Drawing 8]

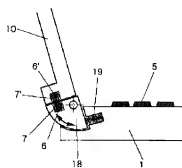


[Drawing 9]

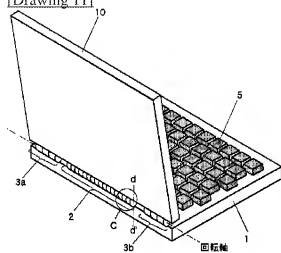


[Drawing 10]

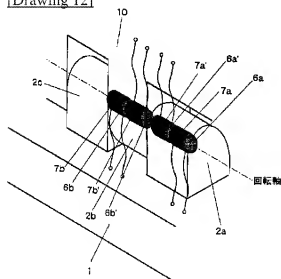




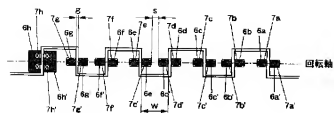
[Drawing 11]



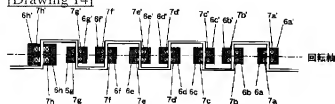
[Drawing 12]



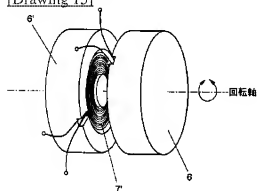
[Drawing 13]



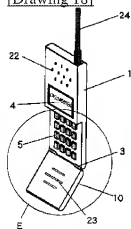
[Drawing 14]



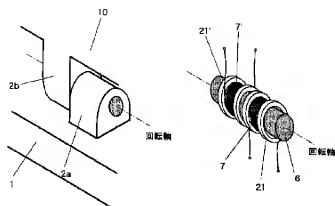
[Drawing 15]



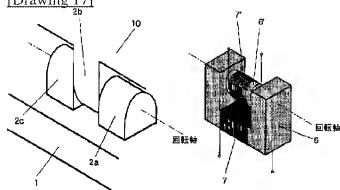
[Drawing 18]



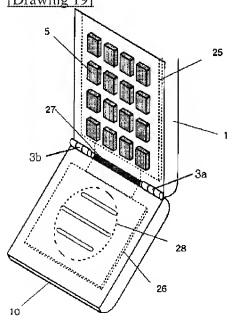
[Drawing 16]



[Drawing 17]



[Drawing 19]



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H 0 4 Q 7/32			H 0 4 B 7/26	V	

審査請求 未請求 請求項の数 4 F D (全 8 頁)

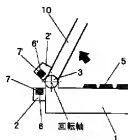
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## (54)【発明の名称】 電子機器

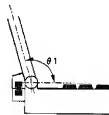
## (57)【要約】

【目的】 折りたたみ部に発生する応力による断線不良の問題を完全に防ぐことが可能で、しかも水や埃等の対環境性に強い携帯電子機器を提供することを目的とする。

【構成】 可動部を有し、その可動部を介して第1の基体と第2基体に内蔵される実装基板間におけるデータおよび電源のやり取りを行う電子機器において、可動部内部にコイルを内蔵し、このコイルにて非接触方式でデータならびに電源のやり取りを行うことを特徴とする電子機器。



(a)



(b)

#### 【特許請求の範囲】

【請求項1】 可動部を有し、該可動部により連結される第1の基体と第2基体に内蔵される実装基板間におけるデータおよび電源のやり取りを行う電子機器において、前記可動部内部にコイルを内蔵し、該コイルにて非接触方式でデータならびに電源のやり取りを行うことを特徴とする電子機器。

【請求項2】 請求項1記載の電子機器において、前記可動部の開閉角度が限定される可動範囲でのみデータならびに電源の伝達が可能となることを特徴とする電子機器。

【請求項3】 請求項2記載の電子機器において、データならびに電源の伝達が可能となる可動部の開閉角度は、前記電子機器利用者が機器の利用が可能となる角度と一致することを特徴とする電子機器。

【請求項4】 請求項1記載の電子機器において、可動部において第1の基体と第2基体とを物理的に分離できることを特徴とする電子機器。

#### 【発明の詳細な説明】

##### 【0001】

【産業上の利用分野】本発明の主な利用分野は可動部により連結される第1の基体と第2基体とからなり、コンパクトに折り畳んで携帯できる携帯端末機器に係わり、特にその可動部の機械的信頼性を向上させるものである。

##### 【0002】

【従来の技術】近年、電子機器の小型化、省電力化に伴い、各種電子機器の携帯化が盛んに進められている。代表的なものには携帯電話機、PDA、ノート型パソコンなどがある。これら小型携帯端末機器の中にはその携帯性および収納性を向上させるためボディの一部を折り畳んで収納時の外形寸法をコンパクトにできるものがある。図18は折りたたみ部を有する携帯端末機器の代表例の携帯電話機の斜視図である。図19は図18のE部の拡大図である。本例の携帯電話機は電話番号や各種メッセージなどを表示するための液晶ディスプレイ、電話番号を入力するためのキーパッド、受信した音声が発生する受話部22、電波を送信および受信するためのアンテナ24を機能的に配置した第一の分割体1と音声を送信するための送話部23を内蔵した第二の分割体10が機械結合部3a、3bにより連結されている。機械結合部3a、3bはチョウツガイ構造となっており、第一の分割体1と第二の分割体10は本のように開閉可能になっている。第一の分割体1と第二の分割体10の連結部における電気的な接続はポリイミドフィルム上に銅箔をケミカルエッチングして所定の配線パターンを形成してなるフレキシブル配線27を用いて第一の分割体1に内蔵される第一の実装基板25と第二の分割体10に内蔵される第二の実装基板26を接続して行っている。28は送話音声を受けるマイクである。フレキシブル配線27は薄くて比較的耐折り曲げ性に

強い。そのため、このような折り曲げ部の電気接続に用いられている。しかし、このような構造では配線が外部に露出するため、物理的外力による損傷、外部からの水分などの進入によるトラブルなどが発生しやすい。また、折り曲げ時に配線にストレスが加わるため繰り返しの折り曲げにおける信頼性にも限界がある。なお、図示はないがフレキシブル配線27を用いない構造として機械結合部3の内部を通じてリード線を配線する事もあるが、この場合も繰り返しの折り曲げによる信頼性を完全に保証することは困難であり、長期にわたる使用において断線不良等が発生することが考えられる。

##### 【0003】

【発明が解決しようとする課題】以上に述べた従来の折りたたみ機構を有する携帯端末機器は分割体間の電気的接続を物理的配線により行っていたため、繰り返しの折りたたみにおける機械的および環境的信頼性が低いという問題点を持っていた。本発明の目的は信号および電源のやり取りを、物理的配線を介さない、電磁結合による信頼性の高い折りたたみ機構を提供することにある。

##### 【0004】

【課題を解決しようとするための手段】以上の目的を達成するための手段は、可動部を有し、該可動部により連結される第1の基体と第2基体に内蔵される実装基板間におけるデータおよび電源のやり取りを行う電子機器において、前記可動部内部にコイルを内蔵し、該コイルにて非接触方式でデータならびに電源のやり取りを行うことにより信頼性の高い折りたたみ機構を提供するものである。

##### 【0005】

【作用】上記手段により構成される折りたたみ機構を有する携帯端末機器は折りたたみ部に物理的配線がないため、折りたたみ時に内部の回路を構成する部材に対し一切のストレスを与えないため繰り返しの折りたたみにおいても信頼性を確保できる。また機密性を高められることから環境に対する信頼性も高めることができる。

##### 【0006】

【実施例】図1～図8を用いて本発明の第1の実施例について説明する。

【0007】図1は本発明の電磁結合器を用いた電子機器の一例であるノートブック型のワードプロセッサを示す斜視図である。図2は図1に示したワードプロセッサの電磁結合部（図1A部）の拡大透視図である。ワードプロセッサは内部にCPUやその他の電子部品を内蔵し表面にキーパッドが整列されている第一の分割体1と内部にLCDドライバなどの電子部品を内蔵し、表面に液晶ディスプレイを設置した第二の分割体10が2箇の機械結合部3a、3bにより連結された構造を持っている。機械結合部3a、3bは例えばチョウツガイ構造を有し、機械的動作により第一の分割体1および第二の分割体10を折りたたんでコンパクトに収納できるようにしてある。第一

の分割体1および第二の分割体10の背面には使用時に第二の分割体10に設置された液晶ディスプレイ4が使用者の可視範囲に収まる角度に持ち上げられた時、対向する様に電磁結合部2、2'が配置されている。電磁結合部2の内部にはそれぞれコイル7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, 7i, 7j, 7k, 7l, 7m, 7n, 7o, 7pが所定のターン数巻かれた磁性コア6a, 6b, 6c, 6d, 6e, 6f, 6g, 6h, 6i, 6j, 6k, 6l, 6m, 6n, 6o, 6pから構成される16個の信号用コイルとコイル7q, 7rが所定のターン数巻かれた磁性コア6qから構成される電源用コイルが内蔵されている。電磁結合部2'内部にもこれらのコイルと向き合う様に同様のコイルが内蔵されている。信号用の磁性コア6a~6p, 6e'~6p'には高周波の信号を効率良く電磁結合により伝達するため円筒状の焼結Ni-Znフェライトを、電源用磁性コアには結合の効率とヒステシス損などを考慮してE型の焼結Mn-Znフェライトを用いてある。なお、電源用コイルは1個の磁性コア2個の磁路を形成する用に2ヶ所にコイルを巻線してある。

【0008】次に図3を用いて信号および電源伝送の原理を説明する。図3は電磁結合器を用いたデータ通信の様子を示すブロック図である。図1に示したワードプロセッサの液晶ディスプレイ4への信号および電源伝送を例に説明する。第一の分割体1には液晶ディスプレイ(LCD)4を駆動するための制御信号、アドレス信号、データ信号が送られる。信号は各コイル7a~7pで磁束に変換される。発生した磁束が第二の分割体10に設置される各コイル7a'~7p'に傾斜し、「レンツの法則」により信号が伝達される。第二の分割体10に設置される各コイル7a'~7p'で受信した信号波形は電磁結合特有の双峰波形であるため波形整形回路11所定レベルのデジタル波形に変換する。その後は一般の液晶ディスプレイ駆動法と同様にLCDドライバ12に信号を入力し、液晶ディスプレイ4を駆動する。収納スペースの制限により設置できる信号用コイルの数が信号数よりも少ない場合は論理回路を付加し時分割転送を行っても良い。また、電源は第一の分割体1に内蔵される電源線より供給される直流電源を共振回路801およびコイルドライバ802で構成される電磁結合送電回路8により所定のパルス波形に変換して電源用コイル7a, 7rに送られる。信号と同様に電磁誘導により第二の分割体10に設置される電源用コイル7q, 7rで受けた交流電力を直流に整流する整流・平滑回路901、一定電圧に安定化する定電圧回路902から構成される電磁結合受電回路9より第二の分割体10内部の各種電子部品に供給される。

【0009】図4は図1に示したワードプロセッサの電磁結合部の側面を示す平面図である。電磁結合部2, 2'は第二の分割体10がある角度θ1で起き上がった時、内部のコイル同志が直接対向するように配置されている。角度θ1は液晶ディスプレイの可視範囲の中で任意に設定される。格納時に第二の分割体10を折りたためば

電磁結合部2, 2'は距離が離れ、電源電圧が低下し、第二の分割体10内部の回路は動作を停止するため、使用時以外の無駄な電源消費を防ぐことができる。第一の分割体1と第二の分割体10は機械結合部3のみで物理的に連結されており、折りたたみ時のストレスは機械結合部3のみに集中する。よって機械的信頼性は機械結合部3の構造によって決定され、通信の信頼性と切り離すことができる。すなわち、機械結合部3の機械的動作における磨耗や変形など信頼性を確保すれば良いことになる。

【0010】図5に図1に示したワードプロセッサの電磁結合部に内蔵されるコイルの実装形態の一例であるコイル集合体の斜視図である。図6は図5に示したコイル集合体のB-B'断面図である。これは複数のコイルを実装しやすいように一つの部品(コイル集合体)に組み立てたものである。コイル集合体20は複数個(図4に10個)の円筒状の磁性コア6a~6jにコイル7a~7jを所定数巻いた信号用コイルとE型の磁性コア6kにコイル7k, 7lを所定数巻いた電源用コイルを例えばPPS、液晶ポリマーなどのモールド樹脂で外部端子14の一端形成してなるコイル基体13で保持し、それぞれ巻線の末端を例えばリン青銅からなる外部端子14の端子15a~15l、15a'~15l'にはんだ16a~16l、16a'~16l'にて接続した構造を持つ。本構造によれば各コイルの位置精度はコイル基体13の成形精度で決定されるため高精度である。また、図7示すように外部端子14のみが露出するように全体をモールド樹脂17で埋め込む事によって部品としての信頼性を向上させることができる。上記構造により複数のコイルが一度に実装可能であり、生産性が向上する。

【0011】図8は図1に示したワードプロセッサの第一の分割体と第二の分割体を分離した状態を示す斜視図である。第二の分割体10は物理的配線が無いため機械結合部3を構成する止めピン301a, 301bを取り外すことで簡単に分離することが出来る。よって、本発明の構成によれば部品故障や部品のアップグレードによる交換作業などが簡単に行える。また、分離することによってよりコンパクト化でき、更に携帯性、収納性を向上させることも可能である。さらに、物理的配線に頼らないことから完全密閉構造も可能であり、環境の厳しい中で用途や水洗い等のメンテナンス性の向上も期待できる。

【0012】図9および図10は図1に示したワードプロセッサの電磁結合部の通信範囲を広げる第二の実施例を示す平面図である。前述の実施例は可視範囲の限られた位置での通信が可能であったが、可視範囲は使用者の体型、姿勢によってある程度の幅があり、通信範囲もある範囲で確保されることが望ましい。図9は磁性コア6, 6'の対向部にRを設け、ある角度範囲θ2で結合効率があり変化しないようにしたものである。図10は第一の分割体1側の電磁結合部にコイルを内蔵した可動コイルホルダー18を設置し、押しつけパネ19によって第二の分割体10の移動に追従できるようにしたものである。

【0013】図11～図17を用いて第三の実施例について説明する。図11は本発明の電磁結合器を有するノート型のワードプロセッサを示す斜視図である。図12は図11に示したワードプロセッサの電磁結合部の拡大斜視図である。第一の分割体1と第二の分割体10間のデータおよび電力のやり取りは第一の分割体1に歯歯状に形成された電磁結合部2a、2cと第二の分割体10に歯歯状に形成された電磁結合部2bが噛み合い、電磁結合部2a、2cに内蔵される円筒状の磁性コア6'、6bに所定数のコイル7a、7bを巻線して構成される信号用コイルと電磁結合部2bに内蔵される円筒状の磁性コア6a'、6b'に所定数のコイル7a'、7b'を巻線して構成される信号用コイルが機械結合部3a、3bの回転軸上で向かい合って行われる。第一の分割体1と第二の分割体10の通信を折りたたみ動作の回転軸上にコイルを回転動作によって、通信を行うコイル同士が相対的な位置関係が不変であるように配置してあるため、第二の分割体10をどの位置に回転移動させても通信の信頼性に影響がない。

【0014】図13は図11に示したワードプロセッサの電磁結合部のd-d'断面図である。電源コイルには磁束を効率よく集められる図15に示すようなボットコア6にコイル7を巻線して構成したものをを用いている。図13において各コイルのギャップgは歯歯状の電磁結合部のかみ合わせの隙間によって決定されるので結合の効率と回転動作の摩擦抵抗係を考慮して決められる。同一分割体内に内蔵されるコイルの間隔sは隣接チャンネルの信号をノイズとして拾ってしまうクロストークの影響を考慮して決定されるが、離しすぎると歯歯の幅wが大きくなり電磁結合部2に内蔵できるコイル数が少なくなり、通信速度などが制限されるので、最適値を考慮して設計される。

【0015】また、図14に示すように全コイルをボットコアを用いたものにすれば磁束が閉じこめられるのでコイルの間隔sが小さくて済むコイル数を増加できる。

【0016】図16および図17は全方位で電磁結合が可能なその他のコイル構造の例である。図16は例えば樹脂製のコイルポピン21、21'にコイル7、7'を巻線して構成した信号コイルに円筒状の焼結Ni-Znフェライトからなる磁性コア6を通して通信を行うものである。磁性コア6を回転軸に用い、電磁結合と機械結合の双方を行うので機械結合部を別途設けなくてもよいので構成が単純となる。ただし、磁性コア6の機械強度が保証できないときは機械結合部を別途設けてもよい。図17は第一の分割体1側の電磁結合部2a、2cに例えば焼結Ni-ZnフェライトC型からなる磁性コア6にコイル7を巻線して構成されるコイルと第二の分割体10側の電磁結合部2bに例えば焼結Ni-Znフェライトからなる円筒状の磁性コア6'にコイル7'を巻線して構成されるコイルを組み合わせて通信を行うものである。本構成は磁束が閉じるため結合効率が良い。

## 【0017】

【発明の効果】以上述べたように本発明の折りたたみ部に電磁結合器を有する携帯電子機器は折りたたみ部を介して行われる信号および電源のやり取りを電磁結合によって行うことにより、従来、発生した折りたたみ部に発生する応力による断線不良等の問題を完全に防ぐことが可能なり、しかも水や埃等の対環境性に強い携帯電子機器を実現することが可能となる。

## 【図面の簡単な説明】

【図1】本発明の電磁結合器を用いた電子機器の一例であるノートブック型のワードプロセッサを示す斜視図である。

【図2】図1に示したワードプロセッサの電磁結合部(図1A部)の拡大透視図である。

【図3】電磁結合器を用いたデータ通信の様子を示すブロック図である。

【図4】図1に示したワードプロセッサの電磁結合部の側面を示す平面図である。

【図5】図1に示したワードプロセッサの電磁結合部に内蔵されるコイルの実装形態の一例であるコイル集合体の斜視図である。

【図6】図5に示したコイル集合体のB-B'断面図である。

【図7】図5に示したコイル集合体をモールドした状態を示す斜視図である。

【図8】図1に示したワードプロセッサの第一の分割体と第二の分割体を分離した状態を示す斜視図である。

【図9】図1に示したワードプロセッサの電磁結合部の通信範囲を広げる第2の実施例を示す平面図である。

【図10】図1に示したワードプロセッサの電磁結合部の通信範囲を広げる第2の実施例を示す平面図である。

【図11】本発明の電磁結合器を有するノート型のワードプロセッサを示す斜視図である。

【図12】図11に示したワードプロセッサの電磁結合部の拡大斜視図である。

【図13】図11に示したワードプロセッサの電磁結合部のd-d'断面図である。

【図14】全コイルをボットコアで構成した電磁結合部の断面図である。

【図15】ボットコアを用いた構成のコイルを示す斜視図である。

【図16】全方位で電磁結合が可能なその他のコイル構造の例である。

【図17】全方位で電磁結合が可能なその他のコイル構造の他の例である。

【図18】従来の折りたたみ部を有する携帯端末機器の代表例である携帯電話機の斜視図である。

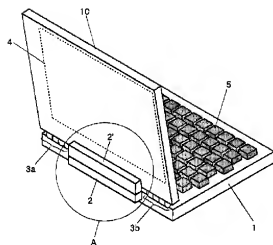
【図19】図18のE部の拡大図である。

## 【符号の説明】

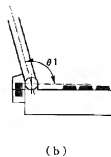
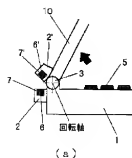
1 第一の分割体

- 2 電磁結合部
- 3 機械結合部
- 4 液晶ディスプレイ
- 5 キーボタン
- 6 磁性コア
- 7 コイル
- 8 電磁結合送電回路
- 9 電磁結合受電回路
- 10 第二の分割体
- 11 波形形成回路
- 12 LCDドライバ
- 13 コイル基板
- 14 外部端子
- 15 巻線溝

【図1】

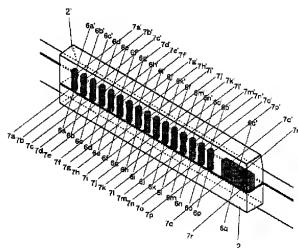


【図4】

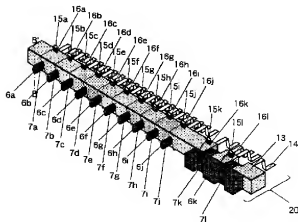


- 16 はんだ
- 17 モールド樹脂
- 18 可動コイルホルダー
- 19 押しつけバネ
- 20 コイル集合体
- 21 コイルボビン
- 22 受話部
- 23 送話部
- 24 アンテナ
- 25 第一の実装基板
- 26 第二の実装基板
- 27 フレキシブル配線
- 28 マイク

【図2】

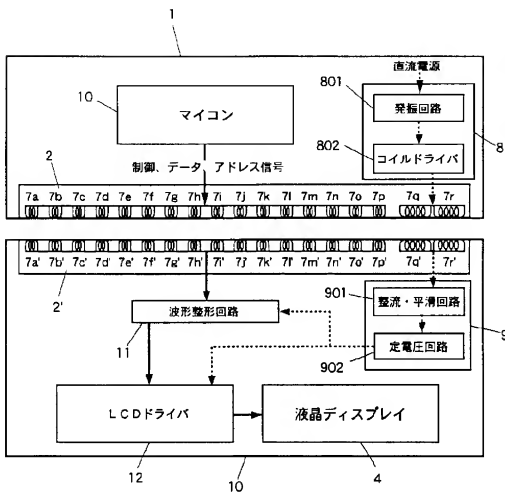


【図5】

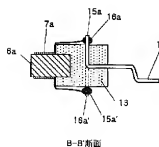




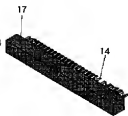
【図3】



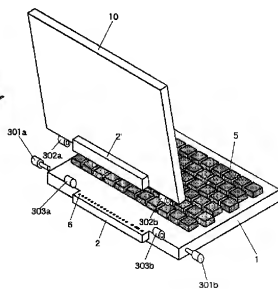
【図6】



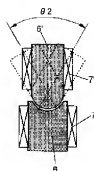
【図7】



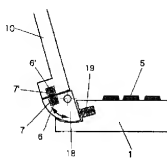
【図8】



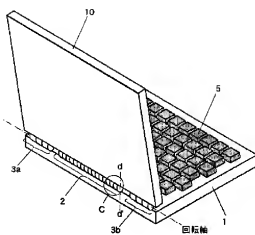
【図9】



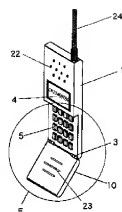
【図10】



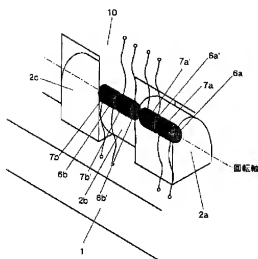
【図11】



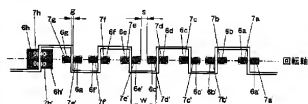
【図18】



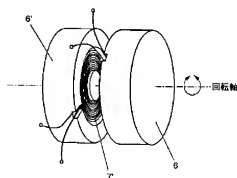
【図12】



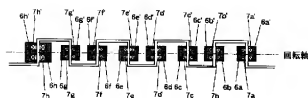
【図13】



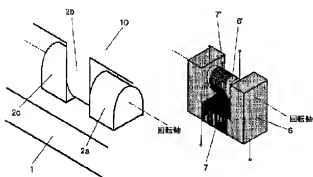
【図15】



【図14】



【图 16】



【图 19】

